

AMENDMENT UNDER 37 C.F.R. § 1.111

Appln. No. 10/020,953

Docket No. A8170

AMENDMENTS TO THE SPECIFICATION

Please amend the third paragraph of page 3 as follows:

Figure 1 is a three dimensional view of the battery ~~after~~before the inner tube collapses;

Please amend the fifth paragraph of page 3 as follows:

Figure 3 is a three dimensional view of one end of the battery ~~before~~after the inner tube collapses;

Please amend the second paragraph of page 4 to the paragraph bridging pages 5 and 6 as follows:

Referring to the Figures 1 and 2, a battery casing 100 houses an electrode assembly with ~~a cathode~~an anode 40, ~~an anode~~a cathode 42, and an electrolytic separator 44. The casing includes an inner tube 10, and outer tube 12, and two end plates 14, 16 to create a sealed annular space-18.

In this embodiment, the inner tube 10 is about 0.007 inches thick with an outside diameter of 0.625 inches, the outer tube ~~12~~18 is about 0.011 inches thick, and the end members are about 0.015 inches thick. The outer tube ~~12~~18 and end plates 14, 16 and are made of 1008/1010 CRS steel, but they may be made of another suitable metal, and the inner tube is made of 304 SS steel.

The inner tube 10 is a ribless surface, which is not reinforced with grooves. The end plates 14, 16 are attached to the ends of the inner tube 10 and outer tube ~~12~~18. In this

embodiment, the end plates 14, 16 are attached to the inner tube 10 by welds 26 and to the outer tube 12~~18~~ by additional welds, but the invention is not limited in this respect.

The ~~cathode~~anode 40 and ~~anode~~cathode 42 are separated by the separator 44 and are spirally wound around the inner tube 10. The inner wall 10 surrounds a hollow core 20. A positive terminal 22 is connected to the ~~anode~~cathode 42 and extends through one of the end plates 14, and negative terminal 24 is connected to the other end plate 16. The inner wall 10 is electrically connected to the ~~cathode~~anode, and is therefore negatively charged.

In this embodiment, the end plates 14, 16 are semi-rigid structures formed by an inner cylinder, an outer cylinder, and a plate that extends between one of the ends of the outer cylinder and one of the ends of the inner cylinder, as shown in Figure 2.

When the pressure created by the charging of the battery increases to a first predetermined level within the annular space, a force within the annular space~~18~~ causes the inner tube 10 to collapse and flatten into the hollow core 20. Figure 3 shows the battery after the inner tube has collapsed. The inner wall 10 is specifically designed so that it will collapse when it experiences a force caused by a pressure at a predetermined level. The ribless surface of the inner wall allows the tube to uniformly collapse rather than break at a predetermined pressure, as occurs in existing venting systems. In this embodiment, the force is about 140 psi. The collapsing of the inner tube 10 increases the volume within the annular space~~18~~. This increase in volume also increases the spacing between the anode electrode and cathode electrode, which reduces the current between the electrodes, and thus the power of the battery.

If the pressure within the annular space 18 continues to increase even after the collapsing of the inner tube 10, the connection between the end plates 14, 16 and the inner tube will break at a predetermined higher pressure. In another embodiment, the pressure at which the connection between the end plates 14, 16 and the inner tube 10 breaks can be the same pressure as the pressure where the inner tube 10 collapses. In this embodiment, the welds 26 connecting the inner tube 10 and end plates 14, 16 are designed to break at a pressure of about 250 to 300 psi. The breaking of the welds 26 at this pressure allows the battery to vent before reaching an unsafe pressure, such as 400 psi.

Please amend the first paragraph of page 7 as follows:

Just like the embodiment described above, when the battery cell reaches an excessive voltage or the cell is exposed to excessive heat, the internal pressure within the annular portion 18 of the battery casing 100 causes the inner tube 10 to collapse and flatten into the hollow core 20. Figure 7 shows the battery after the inner tube has collapsed. This embodiment is designed so that the inner tube collapses at 4.75 Volts. When the inner tube 10 collapses, it makes contact with the wire 30, creating a short circuit between the positive terminal and the negatively charged inner wall 10. This short circuit reduces the excessive voltage, thus preventing electrolyte decomposition within the battery, which would result in an exothermic reaction and significantly increased pressures.